SCIENCE

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MSS. intended for publication and books, etc., intended for review should be sent to Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

OBSTACLES TO EDUCATIONAL PROGRESS[1]

IT is only a commonplace, I know, to say that the serious study of educational organization and administration is largely a product of the past quarter of a century, and that the largest contributions to our knowledge in these fields have been made by students during the sixteen years that belong to the twentieth century. Yet I need to say it as an introduction to the thesis I wish to set up. The past decade and a half have witnessed a remarkable change in attitude toward the study of education. Never before have so many capable men and women directed their attention to a serious study of educational theory and the problems surrounding the proper organization and administration of public education, and never before has the type of the men and women preparing for entrance to the state's educational service been so high as at present.

Schools of education, which now exist in nearly all our leading universities, are almost entirely a twentieth-century product, and are becoming so organized as to render an increasingly important service in training for educational leadership and service. Our knowledge on educational questions, derived in part from our administrative experience, is being rapidly organized into teaching form; fundamental principles in school organization and administration are being established; and a better trained body of administrative officers, with larger and broader vision as to means and ends

[1] Address of the vice-president and chairman of Section L, American Association for the Advancement of Science.

and the significance of public education, is being prepared and sent out. Numerous summer sessions of our leading colleges and universities are contributing much to the dissemination of this newly organized knowledge of administrative principles and procedure among those actively engaged in the educational service. Despite all these recent advances, though, in educational theory and in the organization of our knowledge of proper administrative action, in actual practise throughout the nation our progress at times seems most discouragingly slow. Only in city-school administration have we been able to make real advances, and these only in certain cities and certain sections of the country.

Another recent statement that has already become almost a commonplace is that public education, after the close of the present Great War, will of necessity become a much more important state service than it has ever been up to the present time. The great world changes which will follow in the decade or two after its close —social, industrial and political—are almost certain to be far-reaching and vast in extent, and probably will greatly modify many of our present educational conceptions, as well as many of our methods and practices in hitherto undreamed of ways. A much more fundamental education of our people, especially along industrial and technical and political lines, is almost certain to follow. Our present traditional practises and provincialism in the organization and administration of public education will have to be superseded by a larger and a more forward, as well as a more national outlook. If we are to play our proper part in world affairs in the future—politically, commercially, or industrially—our educational systems must be unified in aims and practises much more than is now the case, world and life needs must enter more largely than at present into the education provided for the masses of our children, and a better-informed intelligence than the local democratic mass must direct our educational efforts, while a much larger nationalism in education must take the place of our present provincialism in school affairs.

We have then to-day a new interest in proper educational organization and administration on the part of a small but an increasing number of selected men and women, and we are facing new national and international needs opening up ahead of us which will make heavy demands on those who possess training and competency for the educational service which will be called for. The number who see these rapidly enlarging educational needs and are securing training to meet the future demands is still far too small to supply the trained and competent educational leadership that will be needed, but this number may be expected to increase slowly as communities offer larger opportunities to such men and women to be of real service. The thesis I want to lay down this afternoon, then, is that it is the lack of opportunity to be of real service which has kept and is still keeping many competent men and women from entering upon or properly preparing for the public educational service; that this lack of opportunity for real service still is, and until the conditions are changed will continue to be, the greatest obstacle we have to face in securing rational educational progress for our country; and that satisfactory educational progress can not be expected until the obstructions created by present laws and practises in educational organization and administration are removed by new legislation. Let us see what are some of the more important of these obstacles.

With us everywhere public education is still largely a local affair. The unit of organization is the school district—city,

county or rural—and in a majority of our states the little democratic school district, inherited in the early days from Massachusetts, is the prevailing unit for the organization and administration of education, and nearly everywhere these little self-governing units are but loosely bound together in the county and state educational organizations. With regard to organization we do not have a national school system, and, aside from the assimilation of the foreign-born, it falls far short of national scope in either conception or purpose. Even our state educational systems exist rather in a uniform school code and in clerical and inspectional oversight than in helpful state supervision, and too often consist largely in the imposition of a general state uniformity on communities in unimportant matters, while neglecting the larger concerns of a broad educational policy for intelligent future development.

It is to the school district, then—rural, township, city or county—that we go for the ultimate source of educational organization and administration in this country. Some of our states have twelve to fifteen thousand such little units, actuated by no common purpose or policy and devoid of any proper conceptions as to the nature or purpose of education in a modern state. Over these, as represented by their popularly-elected trustees, is a county school official with statistical and clerical functions but with little real power, and over the county organization is a state educational official with similar limited powers. In a few of the North-Central states we find that the township has replaced the school district, with the county over it; while in the New England states the districts have been abolished in favor of the town, this in turn being responsible to the state. In a few other states, mostly southern, the county has been made the administrative unit, while in all the states we find the separate city school district, with more or less independent powers in organization and administration. Let us leave the city aside for a moment and examine the obstacles to educational progress as found in rural and county educational organization.

That rural education almost everywhere is in need of a radical reorganization and redirection is another commonplace statement. Too frequently our rural schools attain to but a small fraction of their possible efficiency and render but small service in improving the conditions surrounding life on the farm. Too frequently their management is shortsighted, their equipment poor, their instruction ineffective, and adequate supervision is too often entirely lacking. That such schools contribute but little to the improvement of rural life is well known. The trouble lies chiefly in that the system of organization and management still followed is half a century behind the times, and that, in consequence, there is no opportunity for men and women of adequate training and capable of real leadership to make themselves effective in the improvement of rural education and the conditions surrounding rural life.

The so-called district system, with its large powers for local control, represents democracy gone to seed, and it stands today as the most serious obstacle in the way of the improvement of rural education. What is needed is larger and more flexible units for the organization of instruction; larger units for taxation, with a resulting more general pooling of both the burdens and the advantages of education; and an administrative organization which will make possible a more rational administration of the education of those who live in the rural districts and small villages of our country. Rural educational progress will be promoted in proportion as the school district is abolished for larger units of organization and control.

While the ultra-conservative nature of the district system makes it a serious obstacle in the way of intelligent educational progress, hardly less important as a hindrance to the improvement of rural education is the political and local nature of the office of county superintendent of schools. In twenty-one of the forty-one American states having such an educational office, the person who ought to be the educational organizer and director of the public-school system of the county is, instead, merely another county political official, selected from among the body of the electorate at the county primary and elected at the county political election, serving but a short period in the office, confined largely to statistical and clerical duties, afraid to assume much responsibility for fear of the enemies he will make in the districts, and with little power to put any educational ideas he might have into effect in the administration of the schools of his county. Generally speaking, the office attracts but few men or women of real training or large capacity for service, and the better trained the superintendent may happen to be the shorter is likely to be his term of service. The office, if we neglect a few well-organized county-unit states, such as Maryland or Utah, offers no educational career to any one, and no premium whatever to any one to make any professional preparation for the organization or administration of rural education. In but few states can a man or woman hope to enter the work of county school supervision—a service of fundamental importance to the children of half our people—on the basis of educational competency, or to retain the office on the basis of efficient educational service. The result is that the office offers but a temporary job to the few local residents willing to consider political candidacy, and that in but few states do we find any county educational organization capable of rendering any real service in the solution of our increasingly important rural-life problem. In consequence the education of rural children is inadequate and misdirected, intelligent farmers leave the farm for town in order that their children may have proper educational advantages, but little attention is given to preparation for rural service by either our normal schools or our colleges of education, and but few men or women think of trying to make any preparation for the organization or direction of the work of our rural and small village schools.

Passing from the county to the state, we find something of the same conditions prevailing. In nearly three fourths of our states the chief educational office of the state labors under the same political incubus as does that of the county superintendency of schools. Due to the larger area for selection and the enlarged competition, better men are usually secured for the position. As yet, however, but little attention has been given to any serious study of the problems of state educational organization and administration, and the political basis of the selection of the chief educational officer for most of our states places no premium on any other than political preparation. The great improvement in the work of some of our state educational departments within recent years, aside from the states where non-partisan appointment from the nation at large has replaced political nomination and election from the state, has been due either to a state superintendent of superior ability rising above the limitations of his office or to the appointment of a number of state commissioners or agents or specialists, these having been provided for under special laws and given special powers of supervision and inspection. In but few of our states, though, can we as yet be said to have a well-thought-out educational policy which is being followed for the improvement of

education generally throughout the state. To change this condition the obstacle presented by the method now in vogue for choosing the chief state educational officer needs to be eliminated, with a view to opening up to the state a chance to go into the markets of the whole country with the money the state feels able to pay to secure the services of the best prepared person available for the work at hand. The office of state superintendent of public instruction is, potentially at least, a much more important office than that of president of the state university; actually it is far from being so. It is not difficult to imagine what would be the condition of our state universities if we had continually selected the presidents of these institutions from among the residents of the state and by the same methods that have prevailed for so long in the case of the chief educational officer of the school system of the state. An important line of progress for the near future, then, in the case of both state and county superintendencies of education, is the opening up of these offices to educational competition, as is now the case with high-school principalships and city school superintendents. That such a change would give much encouragement to the study of the important larger problems of national welfare which surround the proper organization and administration of state and county systems of public education, there can be little question.

Turning now to the city school district we find much better conditions prevailing in the matter of the selection of educational executives. City superintendencies and high-school and elementary-school principalships have for a long time been on an open competitive basis in all our better managed cities, and in such a prohibitive protective tariff against brains and competency from the outside has not prevailed. The selections by city boards of education have not always been of the best—frequently otherwise—but the possibilities of a career and a chance for constructive service have in general been kept open, and these have made their appeal to certain types of minds. As a result, it has been the problems of school organization and administration as they relate to cities which have awakened interest and been studied most carefully. An examination of our educational journals will show that it has been the problems of city school organization and administration that have filled their pages, and the announcements of courses in our normal schools and colleges of education show that it is the city problems which are being studied by their students. These are offered everywhere, but the number of institutions offering courses for the study of the principles underlying the proper organization and administration of state and county school systems is limited indeed. The city has offered the prizes for administrative competency and adequate professional preparation, and practically all who have trained for school administrative service have trained with service in the city as the end in view.

Yet even in city educational organization many obstacles to educational progress still remain. The most of these are survivals of the school district or village stage in our educational evolution, or they are obstacles that arise from the lack of any proper conception as to the fundamental principles underlying proper educational organization and administration on the part of the public. The proper organization and administration of a city school system has become a highly expert piece of administrative service, and adequate results are no longer possible if proper administrative procedure is continually interfered with by the well-meaning ignorance or the personal-friendship ideas of

school board members or city officials. It is along these lines that we to-day encounter the greatest obstacle to successful educational administration in our cities. While it would be easy to enumerate a dozen such, I will content myself with a mention of the three which seem to me to be the most important obstacles to intelligent educational progress in the administration of our city school systems.

The first of such obstacles I would enumerate arises where the school superintendency for the city has been made an integral part of the government of the city. The ordinary lawyer, city official or politician finds it hard to understand why students of educational administration object to the apparently perfectly logical position of the schools as a part of the city governmental organization. They regard the school service as on a plane of practical equality with other forms of municipal service, and would place it on the same level as the other city patronage departments of fire, parks, police, streets and public work. Instead, the school is and ought to be regarded as a creation of the state, ranking with the home and the church as an institution for the advancement of the public welfare by the training of the next generation of citizens, and the state must see that it is not reduced to local patronage ends. These other departments represent a municipal corporation, erected to carry out municipal ends; the school is a state corporation to carry out a great state purpose. The experience of our American cities has shown clearly that efficient school administration is promoted by the complete divorce of city government and school control. To make a school board dependent upon the city government for direction and finance, and subject it to the annual scramble for city funds, is to oppose a serious obstacle to proper educational progress and to subordinate the education of the children in the city to the exigencies of city government. As the directors of a state corporation, representing the most important interest of every community, the school board should be free to carry on its work and, within certain limits set by state law, to levy the necessary taxes, free from any interference by the mayor, council, or other city officials.

The second obstacle to proper educational progress in city school administration which I would enumerate is the confusion of functions and responsibilities as between the school board, on the one hand, and the executive officers which the board employs to direct the work of the schools, on the other. Such a confusion arises in part as a result of the rapid evolution of cities from school districts and villages, the tendency being to retain functions once exercised, and in part from a lack of any clear understanding, on the part of the representatives of the public, as to what they are elected to do.

Our laws quite generally give all legal authority to the school board. Only in a few recently reorganized cities operating under special charter does the superintendent of schools have any definite powers and responsibilities. Usually the board has everything, and the superintendent only what the board sees fit to grant him. If the board likes him and trusts him they may grant him wide latitude; if they do not they may take from him practically every power that is vital to the successful administration of a system of schools. Such cases have been so frequent in recent years as to preclude the necessity of mentioning them here. School boards in their ignorance or because of pique frequently harass a good superintendent; put the whole city school system into a state of uneasiness and dissatisfaction; and eventually drive the superintendent from office because he has tried to prevent the schools

from being subordinated to local political or personal ends.

School boards of this type interfere with the proper administration of the schools in almost every conceivable way. The writer could give fifty illustrations of the improper exercise of power on the part of city school boards and school-board members which have come to his attention during the past five years, almost all of them being against the best interests of the schools and interfering with their proper administration and development, and more than one good superintendent could be mentioned who has been driven from office by such confusion of functions. Our educational advance is irregular and in spots, and progress is frequently followed by retrogression. The large power of control now exercised by city boards of education, and the lack of any clear definition in our laws as to the rights and functions of the professional expert boards of education are directed by law to employ, is to-day one of the serious hindrances to satisfactory and enduring educational progress. That this condition tends to turn many young men of capacity away from school administration as a career, and certainly drives some of our experienced men into other occupations, can not be doubted. The remedy for this condition lies in legislation that will guarantee to every superintendent of schools a right to be present and be heard when any matter concerning the organization or administration of the schools is under consideration; the clear right of initiative in the selection, promotion and retention of subordinates; and the initiative in many other matters which concern the management of the schools. This will guarantee to the superintendent of schools what may be considered as rights in the interests of the schools, and would in no way interfere with the work of any board of education interested in proper school administration. While I have stated elsewhere that, in principle, it is perhaps wiser that the superintendent of schools should not be entitled to a vote, it may nevertheless become necessary, if our school boards are not otherwise controlled in their ignorant interference with the work of a good superintendent, to follow the practise of a number of our corporations and seat the superintendent *ex-officio* as a member of the board of directors, and with a right to a recorded vote on every important action taken.

A third obstacle to proper city educational progress is the short term—usually one year—for which our superintendents of schools are commonly elected. A trial period of one year may in some cases be desirable, but thereafter the period of election should be long enough—four or five year terms—to give the superintendent an opportunity to carry out a constructive educational policy. The present annual election is a splendid means of keeping superintendents in subjection to boards who want to manage affairs, and to eliminate easily all who can not be kept under perfect control. The short term, the uncertain tenure and the lack of power to do much in too many of our cities not only prevents capable men from rendering effective service to the communities which employ them, but also drives from the service men of ability and promise. The lack of any high professional standards, based on education and professional preparation, the want of a form of a professional state certificate for supervision, coupled with the short and uncertain tenure, also enables boards of education to drive good men from office and then fill their places by others of a much lower degree of professional competency.

If public education in the United States is to increase in importance as a great constructive undertaking of our people; if

after the Great War we are to be called upon to play a new part in world affairs calling for larger homogeneity and national purpose on the part of our people; and if we are soon to undertake new educational efforts along agricultural, industrial, technical and political lines, as now seems certain, it is of fundamental importance that we eliminate from the organization and administration of our schools these features which stand as serious obstacles to their development on a thoroughly professional basis. We must also so shape their administration as to offer good inducements to the best of our men and women to make careful preparation for public service as school administrators, and we must assure them entrance to the work on the basis of preparation and competency, a chance to perform useful and unobstructed service, and the possibility of desirable life careers in the work. That this is not the case today in our county and state educational service, or even in our city educational service to the extent that is desired, is largely due to the obstacles to educational progress, chiefly of a political and provincial type, which I have just enumerated.

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HUNTER OR HUSBANDMAN[1]

The assumption that all the wild life growing upon the land belongs to all the people, and that any one who can do so is free to take it, is, of course, a direct inheritance from the day when all the game belonged to the king; when the king could do no wrong. We, the people, have succeeded the king. We have acquired his rights and privileges—his right to kill, his right to overrun the fields of the farmer, his right to get something for nothing.

We need now to recognize that the day of wanton exploitation is past, and that we have entered upon an era of conservation during which we must live on the increase of nature's products that our own hands have secured for us; no longer something for nothing, but everything for care and forethought and the application of science to bettering the conditions of life.

The primary assumption should be that the region where farmers live is an agricultural community—not a howling wilderness or a hunting preserve.

Hunting there must be to satisfy the human craving for sport—sport of a kind that is normal to the growing up of every youth, and that is a legitimate part of a man's recreation. But hunting is, at best, a savage sport that is pursued with dangerous weapons; and it should be pursued in civilized society only in places set aside for the purpose. The farmer should possess his farm in peace. The part of the public that desires to hunt should have proper places provided, and these places should be publicly marked for hunting; and peaceful farms where the wild life is treasured should not have to be marked against it. As there are public waters stocked by the state in which any one may fish, so there should be public game and forest preserves where one may hunt.

The farmers want freedom from the nuisance of the hunters who are merely raiders and economic pirates, and should unite to secure it. Every man's farm should be his own, free from ravage by hunters, free from menace by guns. All its wild products should be in his own keeping, subject only to his neighbor's interests, rights and welfare. The farmer should be free to raise on his farm any kind of plant or animal without permit or license from any source. Such artificial barriers ought not to obstruct the path of forward-looking agricultural enterprises.

The conservation measures that will best secure these ends are those which will protect and preserve the wild life in suitable places and provide hunting for the future; for men will hunt, and many of the farmers themselves desire this sport. The measures already before us that will go farthest toward removing the hunter from the farmer's premises are these:

[1] Extract from an address recently delivered before an audience of farmers at the New York State College of Agriculture.

1. State game farms, where wild game may be propagated, for distribution to public and private preserves.

2. Reserves, where the wild life may be maintained—forest and game preserves.

There should be not only one great state preserve like the Adirondack State Park, but every county in the state of New York should have its own smaller reserve, made out of the waste land that is still cheap and available. There is land in every county of the state that would be of far more worth if put to raising timber and game. We have talked much about reforestation: we have practised it little.

Portions of such public reserves should be kept as sanctuaries, free alike from the hunter, the lumberman and the engineer; and in these every wild thing, not harmful to the public, should find a place, and should be let alone. These places would serve as centers of natural propagation and dispersal for wild game species; but they would also keep from extermination many other things in which the hunter is not interested.

They would serve the interests of the public at large by preserving to future generations some of the wealth of life with which nature has endowed our country. There are three important reasons why it should be preserved:

1. Its esthetic value. Many of the wild things, both plants and animals, are interesting and wonderfully beautiful.

2. Its educational value: many of these things are important for teaching purposes; and the youth has a right to know what the native life of his native land was like; otherwise he will not be able to understand its early history.

3. Its possibilities of undeveloped economic values. We are only at the beginning of knowledge how to best utilize our natural resources. We should not exterminate the wild species. We do not know what use the future will have for them. Though they are all products of the evolution of the ages, they may be quickly destroyed, as the history of the passing of the wild pigeon shows. Once gone, they are gone forever. The interest that the public has in keeping them is in the long run far more important than the interest of the hunter in shooting or the farmer in raising crops.

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SCIENTIFIC EVENTS

THE TEACHERS' SCHOOL OF SCIENCE

THE Teachers' School of Science, Boston, announces a summer excursion to Alaska under the charge of Professor Geo. H. Barton. The party will leave Boston on July 6, and after a visit to Toronto, will pass through Lakes Huron and Superior, making a short stop at Sault Ste. Marie. It will then visit Fort Williams and Winnipeg, and spend four days at Jasper Park in the Mount Robson region, thence to Prince Rupert, along the Skeena River to Skagway by steamer, via the Inside Passage and the Lynn Canal (fiord), stopping at Wrangall and Juneau. The party will then go by rail over the White Pass and down the Yukon to Dawson by steamer. Returning, the party will visit Lake Atlin, Vancouver, Seattle and Tacoma, spend three days at Mount Ranier and five days in Glacier National Park. A day each will be spent in Chicago and Toronto, and thence the journey will be by steamer through the Thousand Islands and the Lachine Rapids to Montreal and rail to Boston.

The school will also give its annual field lessons in geology and botany. The schedule of the courses follows:

April 21, Fitchburg—Tourmaline crystals, beryl, mica, feldspar; bathylith, granite, concentric jointing; a monadnock.

April 28, Medford—Decomposition and disintegration (exceptional); frost action, talus.

May 5, Hudson—Bed of dolomite in mica schist, with wernerite, sahlite, titanite, etc.; drumlins and channels of a glacial stream.

May 12, Quincy—Bathylith, granite, erupted into Cambrian slates with much contact phenomena.

May 19, Cedar Grove—Transverse fault; anticlinal fold; melaphyr, tuffs, shale.

May 26, Brighton—Old lava flows; igneous intrusions and dykes; amygdaloidal melaphyr; quartz, epidote, calcite, etc., alteration minerals.

May 30, Annual Field Reunion, Wayside Inn and Nobscot.

June 2, Newton Center—Contemporaneous bed; overturned fold; thrust faults, joints.
June 9, 10, Mts. Tom and Holyoke, Connecticut Valley—Differential erosion; trap and sandstone; reptile footprints; volcanic bombs, etc.
June 17, Atlantic—Stratification folds, cleavage; puddingstone, sandstone, shales, tillite.
June 24, Nantasket—Interbedded tuffs and melaphyr; intersection dykes, baked slates.

THE UNIVERSITY OF MICHIGAN MEDICAL SCHOOL AND NATIONAL SERVICE

The faculty of the University of Michigan Medical School on April 2, 1917, passed the following resolutions:

1. It is the opinion of the faculty of the University of Michigan Medical School that in meeting the demands for medical officers in the national service, the military authorities should give first preference for enlistment to the members of the medical classes of the past two years, viz.: 1915 and 1916.

Note.—These young men have recently finished their medical courses and having taken in part or altogether their hospital training, should have the latest and best information in scientific medicine, and not having as yet established themselves in practise, are best fitted to be selected for military service.

2. In view of the probably urgent demands for trained medical men, the faculty of the University of Michigan Medical School desires to place itself on record as being ready and willing to make its courses of instruction continuous through the summers of 1917 and 1918. This proposition will be submitted to the various state boards of licensure for their approval.

Note.—If this provision goes into effect, a week after the close of the present session, the session of 1917–18 will begin. Those who are now juniors will become seniors and may be graduated in January, 1918.

Note.—In taking this step, not only the military demands upon the medical profession, but civil demands as well are taken into consideration.

3. Taking into consideration the future needs of the country for trained medical men, it is the opinion of the faculty of the University of Michigan Medical School that it is advisable for the undergraduate medical students to complete their course of instruction and not to enlist.

4. The faculty of the University of Michigan Medical School recommends that not less than two hours per week be set aside for the military drill of undergraduate students, and that in addition to the ordinary infantry drill, we recommend training along the lines developed by the Clinical Society of Albany, and known as the "Albany Plan."

Note.—The medical officer should first of all be a soldier. This is necessary in order to make him most efficient as a medical officer.

5. That copies of these resolutions be furnished for suggestions of approval or disapproval to the following bodies:

(1) The surgeons general of the army and navy.

(2) The National Medical Committee on Preparedness.

(3) The National Research Council.

(4) The faculties of other medical schools.

6. That a list of the graduates of the classes of 1915 and 1916, with their standing while in the school and their present addresses, be sent immediately to the surgeons general of the army and navy.

BRITISH GOVERNMENT GRANTS FOR SCIENTIFIC RESEARCH

When the establishment of a separate department of scientific and industrial research was announced in December last, Lord Crewe stated that the Chancellor of the Exchequer was prepared to advise the government to devote a sufficient sum to cover operations during the next five years on a scale which would provide four, or perhaps five, times as much for cooperative industrial research as had been spent for the whole purposes of research hitherto. We learn from *Nature* that the civil service estimates just issued include the sum of £1,038,050 to the department of scientific and industrial research, being a net increase of £998,050 upon last year's amount. Grants for investigations carried out by learned and scientific societies, etc., are estimated at £24,000, and grants to students and other persons

engaged in research at £6,000. These grants will be distributed by a committee of the privy council, on the recommendation of the advisory council, to promote the development of scientific and industrial research in the United Kingdom, and will be subject to such conditions as the committee may think necessary. The £1,000,000 grant in aid of industrial research will be paid to the account of the Imperial Trust for the encouragement of scientific and industrial research. The expenditure of the trust will be audited by the comptroller and auditor-general, but any balance remaining on the account will not be surrendered at the close of the financial year. Grants will be made by the directions of the committee of the privy council over an agreed period to approved trade associations for research, to supplement the funds of the associations, and payments in respect of such grants will not be liable to surrender by the grantees at the end of the financial year. We understood from Lord Crewe's remarks on December 1 that for the next five years or so about £200,000 a year would be available for scientific and industrial research, so that apparently the grant of £1,000,000 is the sum which is to be drawn upon for this purpose. The amount estimated for salaries, wages and allowances in the new department is £7,250, which includes £1,500 for the secretary and £850 for the assistant secretary. Travelling and incidental expenses are estimated to amount to £800.

SCIENTIFIC NOTES AND NEWS

THE annual meeting of the British Association for the Advancement of Science, arranged to be held at Bournemouth in September next, has been cancelled. The two main considerations which have led to this decision are the restriction of railway communication and difficulties of accommodation on account of buildings being required for various national purposes. There will probably be a meeting of the general committee of the association in London to receive reports and transact other business. The annual meeting will therefore be intermitted for the first time in the history of the association since 1831.

ACCORDING to a cable from Paris received at Washington on March 29, the Gaudry prize has been awarded by the Geological Society of France to Dr. Charles D. Walcott, secretary of the Smithsonian Institution. This medal was established by the will of the late Professor Albert Gaudry.

PROFESSOR C. S. SHERRINGTON, Waynflete professor of physiology in the University of Oxford, has been elected a corresponding member of the Bologna Academy of Sciences.

PROFESSOR FREDERICK E. CLEMENTS has resigned the chair of botany at the University of Minnesota to accept a position with the Carnegie Institution of Washington.

PROFESSOR ALBERT SAUVEUR, professor of metallurgy and metallography of Harvard University, has been given leave of absence for the first half of 1917–18.

DR. J. F. ILLINGWORTH, professor of entomology, College of Hawaii, Honolulu, has been granted a leave of absence for three years, in order that he may carry on investigations for the Queensland government. His headquarters will be at Gordonvale, Cairns, North Queensland, in the midst of the sugar growing section. An experiment station is to be developed, primarily for the study of the grub-pest, which is such a scourge in certain cane-growing areas.

IT is announced that Mr. A. D. Hall has been appointed permanent secretary to the British Board of Agriculture in succession to Sir Sydney Oliver, K.C.M.G., now resigned.

PROFESSOR W. J. CROOK has resigned from the South Dakota State School of Mines to engage in practical work.

MR. ALESSANDRO FABBRI has been appointed to the post of research associate in physiology in the American Museum of Natural History.

SIR W. E. GARSTIN and Major-General Sir G. K. Scott-Moncrieff have been elected honorary members of the Institution of Civil Engineers of Great Britain.

DR. DOUGLAS W. FRESHFIELD, president of the Royal Geographical Society, has been

elected an honorary member of the Russian Geographical Society.

Sir Ernest Rutherford, professor of physics, University of Manchester, has been elected a member of the Athenæum Club for eminence in science.

At a recent meeting of the Royal Geographical Society the president (Mr. Douglas Freshfield) announced that the king had approved of the award of the Royal Medals for the present year as follows:

The Founders' Medal to Commander D. G. Hogarth, for his explorations and other geographical work in Asiatic Turkey, 1887–1911.

The Patrons' Medal to Brigadier-General Rawling, for his explorations in western Tibet and Rudok, 1903; his journey from Gyanste to Simla via Gartok, and his exploration in New Guinea, 1908.

The Victoria Medal is awarded to Dr. J. Scott Keltie for his eminent services to geography during his secretaryship of the society.

The other awards are as follows:

The Murchison grant to Rai Bahadur Lal Singh for his devoted work as surveyor to the expedition of Sir Aurel Stein.

The Back grant to the Rev. Walter Weston for his travels and explorations in the Japanese Alps —a district previously unknown to Europeans.

The Cuthbert Peak grant to Dr. A. M. Kollas for his explorations and ascent of new peaks in Sikkim and his investigation of the effects of high altitude.

The Gill Memorial to Mr. E. C. Wilton for his geographical work in southwestern China.

Mr. Hubert Jarvis, assistant entomologist of Queensland, made a trip to Hawaii during February. In spite of the brief time that Mr. Jarvis spent in the islands he was very successful in his mission, which was the securing of a considerable stock of the lantana Agromyzid flies for his government. The signal success of these flies in Hawaii, in preventing the seeding of this most troublesome weed, has led other countries to seek similar relief. This Agromyzid, which apparently is an unnamed species, was introduced into the Hawaiian Islands by Mr. Albert Koebele, many years ago.

The directors of the Fenger Memorial Association have made a grant of $400 to Pierce McKenzie for support of chemical and other work under the direction of Dr. E. R. LeCount. He will study the brain and other tissues from cases of heat stroke in order to determine, if possible, better than now known, the cause of the high temperature in this condition.

The Lane Medical lectures at Stanford University for the year 1917 will be delivered by Dr. Simon Flexner, director of the laboratories of the Rockefeller Institute for Medical Research, during the week beginning on October 8. There will be five lectures in all and they will be given on consecutive evenings, at 8 o'clock. The subject of the series will be: "Physical Basis and present Status of Specific Serum and Drug Therapy."

Professor Martin H. Fischer, of the University of Cincinnati, addressed the New York Section of the Society of Chemical Industry, on April 13, on "Some Technical Aspects of Colloid Emulsion Chemistry."

On March 20 Dr. David D. Whitney, of the University of Nebraska, delivered an address before the Science Club of the Kansas State Agricultural College on "The Determination of Sex." This address is the first of a series of addresses on scientific subjects of popular interest planned by the club this spring.

Dr. Alexander Scott, the retiring president of the British Chemical Society, delivered an address entitled "The Atomic Theory" at the annual meeting on March 29.

Sir J. Wolfe Barry will deliver the "James Forrest" lecture before the British Institution of Civil Engineers on May 2, taking as his subject, "The Standardization of Engineering Materials and its Influence on the Trade and Prosperity of the Country."

Lectures to be given at the Royal Institution, London, include two by Professor C. S. Sherrington, on "Tetanus: Its Prevention, Symptoms and Treatment," and on "Rhythmic Action in Muscle and in Nerve." Professor D'Arcy W. Thompson will give two lectures on laws of growth and form; and Professor William Bateson two on "Heredity." Among the Friday discourses will be one on the organs of hearing in relation to war by

Dr. Dundas Grant, another on the complexity of the chemical elements by Professor Soddy, and one on breathlessness by Mr. J. Barcroft.

A MEMORIAL tablet to the late Sir William Huggins and Lady Huggins, executed by Henry Pegram, has been placed in the crypt of St. Paul's Cathedral, and was unveiled on March 29. The president of the Royal Society and the president of the Royal Astronomical Society were the speakers.

DR. JOHN K. MITCHELL, noted as a neurologist and author, died at Philadelphia on April 10. He was fifty-seven years old, and was a son of the late Dr. S. Weir Mitchell.

THE death is announced of Professor Angelo Battelli, the distinguished Italian physicist. He was born at Macerata Feltria (Pesaro) in 1862, and held chairs successively at Cagliari, Padua and Pisa. He was a member of the Chamber of Deputies.

DR. H. F. E. JUNGERSEN, professor of zoology in the University of Copenhagen and director of the department of vertebrates in the university museum, died on February 6, aged sixty-three years.

J. RIEDINGER, professor of orthopedics at the University of Würzburg, has died at the age of fifty-two years.

THE death is also announced of G. Argento, professor of surgery at the University of Palermo, aged seventy. He took a prominent part in public health matters and the hygiene of the hospitals throughout Sicily.

IT is reported from San Antonio that there is widespread infection from hookworm among the troops from Alabama, Mississippi and Texas, but that the disease is now under control.

AT the recent St. Louis conference of agricultural experts looking to production of greater crops as an emergency measure, it was recommended that the congress appropriate $25,000,000 for use by the Secretary of Agriculture in such a campaign. Because of the world shortage of food, it is scarcely possible that the production of staple crops by the farmers of the United States can be too great this year, and it is recommended that boys under military age and men beyond the age and those physically disqualified should be enrolled in the national army for labor and production of food, munitions and supplies. Other recommendations are for creation of an agricultural body under the Council of National Defence to supervise agricultural matters and for the vesting of wide authority in the secretary of agriculture to regulate and standardize food production and distribution. The subcommittees and their chairmen were: Production and Labor, Dr. Henry J. Waters, president of Kansas State Agricultural College; Distribution, Clarence Ousley, of Texas; Organization, President W. O. Thompson, of Ohio State Agricultural College; Economy, J. M. Hamilton, of Montana.

THE report of the Philosophical Institute of Canterbury, New Zealand, for the year 1916, as abstracted in *Nature*, records that the council has recognized the importance of furthering the national movement to advance scientific research and extend the application of scientific knowledge. Addresses on "Education and our National Requirements" and "The Importance of Research to Industry and Commerce," by Mr. G. M. Thomson and Professor T. H. Easterfield, respectively, were arranged with these ends in view. In order that matters connected with research and the chemical application of science should be constantly watched, the council set up a special committee, with Dr. C. C. Farr as honorary secretary. The New Zealand Board of Industries, having invited the institute to send delegates to confer with the board on matters affecting post-war reconstruction, the council appointed the president, with Dr. Farr and Dr. Hilgendorf, to act. Application has been made for part of the £250 granted by the government for research; and investigations are being arranged on the phosphate rocks of Canterbury, the deterioration of apples in cold storage and the electrical prevention of frosting in orchards.

MR. CHARLES BAILEY, formerly connected with the firm of Messrs. Ralli Brothers in Manchester, has presented his herbarium of

British and foreign plants to the University of Manchester. The acquisition of this collection added to the existing herbarium of the Manchester Museum, and more particularly to the large and valuable collection of non-European plants presented to the university in 1904 by Mr. Cosmo Melvill when he retired from business in Manchester, places the university among the foremost of British institutions in respect of this necessary instrument of botanical study and research. The comprehensiveness of the collection may be gathered from the fact that the British portion contains no less than 87,000 separate sheets of mounted plants, while the European portion amounts to 295,000 sheets. Mr. Bailey has made generous provision for the cost of transference of his herbarium to Manchester, and also towards the expenses of completing the mounting of the specimens, so that it may be available for study and reference.

Announcement is made of the establishment for the year 1917–18 in Nela Research Laboratory, National Lamp Works of General Electric Company, of two fellowships in physical research to be known as the "Charles F. Brush Fellowships." One fellowship, extending over the nine-month period of the academic year 1917–18 carries with it an honorarium of $600 and is open to men who have either completed a course of graduate work leading to the doctorate degree or who have had equivalent work, particularly in original research. The other fellowship, extending over the three-month summer period of 1917, carries with it an honorarium of $200, and is open to men who, having completed their academic work, and having begun to teach, desire to spend a summer in original research in Nela Research Laboratory. These fellowships are offered for the coming year through the generosity of Mr. Brush who desires thereby to stimulate interest in industrial physics and to make it possible for young men to undertake research work in physics in the environment of an industrial plant. The Nela Research Laboratory will provide space and all necessary facilities, and will have general supervision over the investigations, which must be consistent with the normal activities of the laboratory. Candidates for these fellowships are requested to apply to the director, Nela Research Laboratory, Nela Park, Cleveland, Ohio.

The State Microscopical Society of Illinois has adopted the following resolution:

Resolved, That the State Microscopical Society of Illinois hereby approve the representations made on its behalf by our Mr. Henry F. Fuller at the federal hearing on the subject of the proposed Dunes Park, on October 20, 1916, stating the attitude of this society in favor of such establishment; and now, since an interested and active opposition to the proposal has been developed in certain quarters from land speculators, be it further

Resolved, That this society most earnestly urge upon the United States Department of the Interior, upon the United States Congress, soon to be in session, and upon the senators and representatives from Illinois and Indiana in particular, the prompt passage of a bill for the establishment of the Sand Dunes region on the southern shores of Lake Michigan as a United States national park; with provision for its proper maintenance, that this rare and wonderful bit of nature so close to the great centers of population may be preserved for our own and coming generations as a place for study and for recreation, a sanctuary of safety for the birds and beasts and insects, the flowers and trees, and all the wild free life of field and brook and forest and beach forever.

Albert McCalla, *Chairman,*
Henry F. Fuller,
Lester Curtis, M.D.

The Ecological Society of America has issued a handbook giving information relative to the scientific activities, travels, field and instrumental experience, laboratory and experimental work, and taxonomic specialties of the 307 members of the society. Copies can be secured by addressing the secretary-treasurer, Dr. Forrest Shreve, Tucson, Arizona.

The completed laboratory building and plant houses of the Brooklyn Botanic Garden will be dedicated on April 19–21. There were planned formal exercises followed by a reception on Thursday evening, the 19th, sessions for the reading of scientific papers on Friday morning and afternoon, and on Saturday morning;

a popular scientific program on Friday evening, and a conference on Saturday afternoon with teachers in Brooklyn schools to consider how the Botanic Garden may become most useful to the schools in connection with their teaching of botany, nature study and geography. About fifty papers have been offered for the scientific programs. The principal address on Thursday evening was delivered by Professor John M. Coulter.

THE D. O. Mills Expedition to the Southern Hemisphere, sent from the Lick Observatory and maintained at Santiago, Chile, for a number of years past by recurring gifts from the late D. O. Mills and Mr. Ogden Mills, is now to be continued for another five years, subscriptions for this purpose of one thousand dollars per annum each having been made for five years by Mr. Ogden Mills, Mr. William H. Crocker, Mr. F. W. Bradley, Mr. A. B. Spreckles and Mrs. William H. Crocker, and of one thousand dollars each for 1917–18 by Mr. W. B. Bourn and Mr. Gordon Blanding.

WE learn from *Nature* that the agricultural institute of Alnarp proposes to devote a plot of its land and about £4,000 to the erection of a building for studies in heredity, under the direction of H. Nilsson-Ehle, the recently appointed professor at Lund. It will also provide a maintenance grant of £200 per annum. It is felt that such studies are of the greatest importance at this time, when Sweden is thrown on its own resources in the matter of food production, and the institute is convinced that any material sacrifices it may make for this purpose will be more than repaid by the economic results of the research, on which the institute will naturally have the first claim.

UNIVERSITY AND EDUCATIONAL NEWS

THE new laboratory for chemistry at the University of Cincinnati was opened on April 7. The ceremonies took place at McMicken Hall, Judge Rufus B. Smith presiding. Mr. Emil Pollak made the formal presentation of the building. Dr. Lauder W. Jones replied on behalf of the department of chemistry, Dr. John Uri Lloyd on behalf of the American Chemical Society. The main address was made by Dr. Chas. E. Herty, who spoke on "The Swing of the Pendulum in Chemistry." A dinner, arranged by the Cincinnati Section of the American Chemical Society, was given at the Gibson.

THE valuable engineering library of the late Robert Gillhan, of Kansas City, Mo., has been donated by his sister-in-law, Mrs. Albert Marty, to Drury College, Springfield, Mo. Among the collection of books are complete files of the chief engineering journals of America, handsomely bound in three-quarter Russian.

SEVERAL teaching fellowships in anatomy (including histology and embryology) and physiology (including physiological chemistry) have been authorized in the University of Minnesota, Minneapolis. These fellowships are renewable for a three years' term, with successive annual stipends of $500, $600 and $700, and lead to the degrees of M.A. and Ph.D. in the graduate school.

THE trustees of Toledo University in special meeting on April 10 refused to accept the resignation of Professor Scott Nearing, dean of arts and sciences, formerly of the University of Pennsylvania.

THE necessary alterations have been made to enable the department of anatomy at University College, London, to be opened for the reception of women medical students next October.

THE George Washington University Medical Society, composed of the alumni and faculty of the medical school, at a recent meeting elected Dr. W. Ashby Frankland, president; Dr. Coursen B. Conklin, vice-president; Dr. Thomas Miller, secretary, and Dr. Edward G. Seibert, treasurer.

DR. WILLIAM DUANE, physics, and Dr. Walter F. Dearborn, psychology, have been promoted to full professorships in Harvard University.

DONALD FRASER MCLEOD, assistant professor of civil engineering at the University of Mis-

sisippi during the last four years, has been promoted to be professor of municipal engineering.

Mr. D. Keilin, of Magdalene College, Cambridge, has been appointed assistant to the Quick professor of biology.

DISCUSSION AND CORRESPONDENCE

THE RÔLE OF BOYLE'S LAW IN CLINICAL SPHYGMOMANOMETRY. A REPLY TO A. M. BLEILE

In a paper read before the American Physiological Society Dr. Bleile[1] discusses an application of Boyle's law which I made in developing the theory of the oscillations of pressure produced in the compression chamber of a sphygmomanometer by the arterial pulse.[2] My statement of this law, worded so as to fit the conditions obtaining in my experiments, was as follows: ". . . the rise of pressure determined by the addition of a given volume of incompressible material to a confined, gas-filled space is proportional to the pressure of the gas filling the space." Dr. Bleile illustrates the action of the law by paraphrasing the example in my paper thus:

> With a given volume pulse change, if the arm band pressure is at 100 mm., the pulse wave shown by the arm band manometer would be *only half as great* as it would with the same volume pulse but with the arm band pressure at 200 mm.

He then goes on to say that

> upon testing this hypothesis by the help of a suitable physical model it is demonstrated that such is not the case. On the contrary, it is demonstrated that the oscillations of volume occupied by a given mass of gas produce inversely proportional oscillations of absolute pressure. Or, in other words, the absolute pressure of a given mass of gas is inversely proportional to the volume. . . . Therefore, the results of the present work are in harmony with Boyle's law but are contrary to Erlanger's hypothesis.

This statement would lead one to suppose that in my application of Boyle's law I have committed the mistake of making the relation between pressure and volume a direct instead of an inverse one. This, however, is not the case. If my statement of the law is compared with Dr. Bleile's, it will be found that in this respect there is not the slightest difference between them. Thus, to paraphrase my statement so as to make it conform with Dr. Bleile's, "the addition of a given volume of incompressible material" *reduces* the volume of the given mass of gas; this reduction causes a "*rise* of pressure," which "is proportional to the (initial) pressure of the gas filling the space." In this statement the relation between volume and pressure (italicized) obviously is an inverse one. What evidently confused Dr. Bleile is the introduction into my statement of the word "proportional" for the purpose of expressing the relation between the *initial pressure* of the confined gas and the *final pressure* developed upon reducing its volume. That this relation is correctly expressed can easily be, and has been, confirmed by the use of very simple apparatus.

Having made it clear that there is no discrepancy between my and Dr. Bleile's statements of Boyle's law, I now desire to add that Dr. Bleile is right in criticizing my *example* of the application of the law. For I inadvertently employed in the example the pressures read directly from the mercury manometer instead of the absolute pressures, though, in the form in which Dr. Bleile repeats it, the example is in perfect accord with Boyle's law, if it is understood that the pressures are absolute. The failure to express the pressure in absolute terms affects, however, only the magnitude of change, not its sign, and therefore does not alter in any material way the development of the theory of the compression oscillations; for my only object in invoking Boyle's law was to show that under the particular set of ideal conditions premised, namely a rigid compression chamber, a compressible transmitting medium and an inextensible artery, the amplitude of the pressure oscillations resulting from the filling and emptying of the artery must *increase* as the compressing pres-

[1] "An Application of Boyle's and Avogadro's Law to the Oscillations of the Manometer in Clinical Measurements of Blood Pressure," *Am. Jour. of Physiol.*, 1917, XLII., 603.

[2] "The Mechanism of the Oscillatory Criteria," *Am. Jour. of Physiol.*, 1916, XXXIX., 401.

sure increases from the diastolic to close to the systolic level. And it was shown that under approximately this set of conditions such is actually the case (see Figs. 10 and 11).

But even if Boyle's law did (and it actually does not) determine a diminution instead of an increase in the amplitude of oscillations with increasing compressing pressure, the development of the theory of compression oscillations would not have been affected in the least. For in the further development of the theory it is shown (Figs. 12 and 13) that under the influence of additional conditions obtaining in sphygmomanometry the consequences of Boyle's law become relatively so insignificant that the amplitude of oscillations, instead of increasing, as the compressing pressure rises from the diastolic to the systolic level, actually decreases.

JOSEPH ERLANGER
WASHINGTON UNIVERSITY MEDICAL SCHOOL,
ST. LOUIS, MO.

THE UNIT OF PRESSURE

TO THE EDITOR OF SCIENCE: The announcement that the French Meteorological Service has, beginning January 1, 1917, decided to publish atmospheric pressure data in units of force instead of millimeters as heretofore, makes it necessary once more to call attention to the fact that the proper unit for the expression of pressure is not the *millibar* but the *kilobar*. The scientific reasons for this have been given elsewhere at length. Another valid reason, however, may be now mentioned.

There has recently been developed a new type of condensation high-vacuum pump. I refer to that of Professor Langmuir. Pressures as low as 10^{-5} bar have been obtained; and there is little doubt that very much lower pressures can be produced by cooling the bulb to be exhausted, in liquid air, so as to decrease the rate at which gases escape from the walls.

The unit *bar* is here used (and I believe this is the practise of the General Electric Company and will of course be followed by physicists, chemists and others working on allied problems) in its right sense, namely, the accelerating force of one dyne per square centimeter. This is 10^{-6} megabar. In the case of this type of pump we have a pressure of 10^{-11} megabar or 10^{-11} standard atmosphere.

The millibar then in daily use becomes what it properly is, 10^{-3} bar. The European Weather Services trying to express atmospheric pressures in millibars are in error, and the correct values are one million times greater.

Fortunately, it is an easy matter to change *mb* to *kb*. And this should be done on all tables, charts, etc., published by European meteorologists.

ALEXANDER MCADIE

A RELIEF MAP OF THE UNITED STATES

TO THE EDITOR OF SCIENCE: With reference to the suggestion in SCIENCE of March 9, relative to a large relief map of the United States, may I be allowed to state that this is a matter which I often discussed with the late E. E. Howell, who at one time had it under serious consideration? It was then my view, to which I still adhere, that there was a limit in size for such objects, beyond which nothing was gained. This was particularly impressed upon me some years ago while studying some of the maps of celebrated battlefields in German museums. In these large models, details toward the center, on account of distance from the eye, were as inconspicuous as though on a smaller scale and closer at hand. In short, the effect of the enlarged map was wholly lost owing to the necessary distance of the observer. A small map near at hand would be much less expensive, and fully as satisfactory.

With Dr. Clarke's remarks in SCIENCE for March 23 I fully agree, data not being at hand for anything but the most general topographic features over a large portion of the area of the United States. The plan, as it appears to me, is wholly impracticable.

GEORGE P. MERRILL
U. S. NATIONAL MUSEUM,
WASHINGTON, D. C.

QUOTATIONS

RESEARCH IN MEDICAL SCHOOLS

AN important report[1] in this issue of *The Journal* shows that of the twenty-six founda-

[1] "Medical Research in Its Relation to Medical Schools." A Report by Drs. Frederic S. Lee, Richard M. Pearce and W. B. Cannon, composing

tions for medical research in this country, seventeen, or nearly two thirds, are in connection with medical schools. The report also intimates that the "great growth of the spirit of research in this country" accompanied "the phenomenal development which medicine has undergone in recent years." In fact, the growth of medical research has been in direct proportion to the increase in the number of full-time, salaried professors in medical schools. This increase has been influenced, to a certain extent at least, by the inclusion of the possession of full-time teachers and the conduct of resarch work as one of the ten requisites in the basis[2] on which the Council on Medical Education rated medical schools in its first published classification. Since full-time teachers were urged chiefly in the laboratory branches, the development of research has been most rapid in that division of the medical school. Only a few medical colleges were amply financed to provide full-time professors in clinical departments and, therefore, only a few have all departments, laboratory and clinical, carrying on active research. With larger numbers of full-time clinical professors medical research in medical schools will attain to a higher degree of efficiency than is possible where that research is in isolated laboratory departments. There can not fail to be better results where all departments of the medical school are interested and cooperating in research, since then any department has the advantage of all the resources of the medical school; any discovery may be tried out under adequate facilities and safeguards and its value established or disproved. In fact, a modern medical school, with its skilled faculty; with its laboratories thoroughly equipped for medical instruction and research, and with an abundance and variety of clinical material at its command, constitutes the ideal arrangement for medical research. On the other hand, the medical school can not reach its highest efficiency in teaching unless it is permeated by the spirit of investigation that is engendered by research. The student can not fail to be benefited. He appreciates better the importance of the fundamental medical branches; that the training in the medical school merely admits him to the field of medicine with its limitless possibilities for usefulness, and that his future success depends on investigation, on keen observation, on accuracy of judgment, and on the skill with which he applies his knowledge. Graduates of medical schools in which research is a prominent feature of the work will be better able than those of other schools to cope with the multiform problems which confront the modern practitioner of medicine.—*Journal of the American Medical Association.*

the Committee on Medical Research of the Association of American Medical Colleges, read at the Annual Meeting in Chicago, February 6, 1917.

2 "Essentials of an Acceptable Medical College." Report of the Council on Medical Education to the House of Delegates of the American Medical Association, June 6, 1910, *The Journal of the American Medical Association*, June 11, 1910, p. 1975, paragraph 12 and p. 1976, paragraph 8.

SCIENTIFIC BOOKS

Metamorphic Geology. By C. K. Leith and W. J. Mead. Henry Holt & Co., New York. 1915.

Metamorphism as defined by the authors embraces "all mineralogic, chemical and physical changes in rocks subsequent to their primary crystallization from magma." That is, it includes all changes produced by weathering, disintegration, decomposition and deposition by sedimentation or from solution, as well as those processes that solidify by crystallization and rearrangement, and thereby form crystalline schists. In this sense all rocks except unaltered igneous rocks are metamorphic rocks, namely, soils, sedimentary strata, and crystalline schists. While a comprehensive treatment of all manner of alterations which may take place in rock masses is the logical and satisfactory method, it would seem advisable to employ some other term for the whole process than metamorphism, which has acquired through long usage a more restricted application.

Naturally the subject is separated into two parts, that of the destructive alterations, and that of constructive ones, which, following

Van Hise, are designated as katamorphic and anamorphic.

The object of the book is said by the authors to be the presentation of the current knowledge of this comprehensive subject in some perspective by means of quantitative methods of comparison and discussion. They say "It is not a handbook of metamorphism in which one may expect to find an adequate description of metamorphic details." There is no description of a metamorphic rock anywhere in it. It is evidently prepared for students who have a knowledge of the petrography of all kinds of rocks, and the ability to determine minerals optically and chemically. It is, in fact, a book for advanced workers in petrology and for geologists interested in the broad problems of sedimentation and the redistribution of mineral matter in various ways.

The authors are unable to follow Van Hise in the emphasis he placed on his so-called zones of katamorphism and anamorphism, for, as they remark, so many other factors than depth enter into the processes of alteration that at any depth, or at the same depth at different times, the changes may be in opposite directions for different kinds of rocks. Or, as they have also expressed it, "Depth is only one of the factors determining intensity of conditions. Igneous intrusion, mineral and chemical composition, the differential stress conditions, etc., all play their parts."

In Part I. the decomposition, or katamorphism, of rocks is discussed with respect to several types of rocks as illustrated by specific instances, such as a granite from Georgia, and a gabbro or diabase. Another example is the production of bauxite from nephelite-syenite, which is called an "acid igneous rock," and the production of laterites from "basic" igneous rocks. The decompositions of ores and of sedimentary rocks are also discussed. In each case the mineral and chemical changes, as well as those of volume and density, are considered in general terms. This is followed by a speculative discussion of the probable redistribution of the constituents of the average crystalline and igneous rock during decomposition. The speculative character of the discussion rests upon its apparent quantitative elements, since it is necessary to assume definite quantitative values for factors concerning which there can be no definite quantitative knowledge. Moreover the petrographical basis of the discussion is open to serious question in that it assumes that all igneous rocks may be embraced under the terms "acid" and "basic," or granites and basalts (!), and that estimates of the average composition of these have definite values. The value of deductions derived from general averages of highly complex factors is always doubtful for the reason that an average is too often a graveyard of facts.

Part II. deals with the construction or integrating changes in rocks, or anamorphism. It includes cementation, dynamic metamorphism and contact or thermal metamorphism. Various types of rocks are considered with reference to these possible modes of transformation; clays, sands, carbonates, igneous rocks, mineral deposits and ores. The cleavage and textures of the crystalline schists are discussed at considerable length, and the discussion closes with a general review of the results of anamorphism and of the probable processes, the conclusions being of special interest and importance, but too extensive to be cited here.

There follows, in Part III., a general discussion of metamorphism in the broad sense in which the authors use the term, which is made to include a discussion of the origin of residual clays and soils, glacial deposits, transported clays and muds, sands and sandstones, calcareous sediments and crystalline schists. In the case of the schists it is found from an investigation of chemical data that "chemical criteria do not satisfactorily discriminate schists of sedimentary and igneous origin." They fail in those cases where other criteria fail. The discussion also considers ocean, lake, river and underground solutions as by-products of the metamorphic cycle, and the authors suggest that the metamorphic cycle be made the basis for the genetic classification of commercial mineral products.

In concluding the discussion they say that "The metamorphic cycle may be regarded as indicative of a great pulsational alteration of

the earth's surface, kept going through the running down of energy and its escape from the earth," and they remark further that this view of the significance of the metamorphic cycle involves a slight modification of the prevalent interpretation of Hutton's law of uniformitarianism in that while the same series of processes are operating to-day as in the past they are now working on different propositions and distributions of substances than formerly, with consequently slightly different results.

A fourth part of the book is devoted to suggestions as to laboratory work in metamorphism, which by reason of its very general character appears to have been prepared as suggestions for instructors of laboratory students rather than for the students themselves. The book is a valuable contribution to the broad geological problems connected with changes of all kinds which take place in rocks, but its title is somewhat misleading.

J. P. Iddings

SPECIAL ARTICLES

A PLANT MEMBRANE FOR DEMONSTRATING OSMOSIS

The writer has noted with interest that the authors of recently published text-books in botany are still advocating the use of egg membranes and parchment membranes for the demonstration of osmosis. It is unfortunate that botany teachers should limit themselves to animal membranes, parchment membranes, or celloidin membranes in demonstrating to students this very important phenomenon in plant physiology. This is especially true when we have readily available a natural plant membrane which serves the purpose admirably. I refer to the testa of the lima bean.

Osterhout[1] has suggested the use of the testa of the lima bean in some osmosis experiments of rather limited visual value. In the botanical laboratories of Kansas University Professor W. C. Stevens[2] has used this membrane in the type of osmosis demonstration providing for a rise of the more rapidly diffusing liquid in a glass tube of narrow diameter. In our own classes we have found the experiment so satisfactory that the method is here presented in detail.

Two days before the experiment is to be set up, place a number of clean lima beans on clean moist paper or absorbent cotton in a glass jar and cover with a glass plate. As germination progresses some of the seed coats will split almost as soon as swelling begins. Others will stretch greatly without splitting. The latter will best serve for the experiment. It is also important to discard any which show signs of bacterial or mold activity. After selecting the bean to be used carefully split the testes through the micropyle and hilium and remove the two halves. Each will serve as an osmotic membrane. Soak the membranes in water for a few minutes to remove any wrinkles. With ordinary narrow rubber bands fasten the membranes tightly over the smooth ends of two clean glass tubes with inside diameters of 4–7 mm. Sugar or salt solutions may now be run into the tubes from the open ends, using a wire or fine glass rod to direct the flow. The tubes should be filled to a height of two or more inches and the level marked with accuracy. Be careful to avoid bubbles. The tubes may now be supported vertically by ring stands with the bean testa in contact with water in a glass dish. The height of the liquid in the tube will rise almost immediately and will continue to do so for several days. The usual variations of such experiments as to the liquids used may be satisfactorily employed with this membrane.

The writer has found this experiment the most simple of the osmosis demonstrations to set up. Five minutes is adequate with the apparatus at hand. With ordinary care the results are satisfactory in nine cases out of ten. The students appreciate a real plant membrane to illustrate plant osmosis. It is advisable if time permits to set up the egg experiment also for its general biologic value.

As to the value of osmosis demonstrations in elementary college courses in botany, we use

[1] Osterhout, W. J. V., "Experiments with Plants," 1906.

[2] Shull, C. A., "Semipermeability of Seed Coats," *Bot. Gaz.*, LVI., 183, 1913.

them in our laboratory to emphasize differences in diffusibility between crystalloid and colloid solutions in studying the nature of protoplasm, to show the method of entrance of solutions into root hairs, and to illustrate a factor in the ascent of sap in stems. The experiments never grow old to the student of inquiring mind.

ORVILLE TURNER WILSON
UNIVERSITY OF CINCINNATI

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE[1]

SECTION D—ENGINEERING

THE first session was held in the morning of Thursday, December 28, in the engineering building, Columbia University, Vice-president Dr. Henry M. Howe in the chair, with an attendance of about 65. It was announced that the sectional committee had recommended for election to the general committee for the office of vice-president, Dr. Henry S. Drinker, president of Lehigh University, South Bethlehem, Pa. The following officers were elected by the Section:

Member of Council—Professor F. L. Bishop, of the University of Pittsburgh.

Member of General Committee—Professor D. D. Jackson, of Columbia University.

Member of Sectional Committee—Professor A. E. Burton, of the Massachusetts Institute of Technology.

The program of the session, which was devoted to sanitary engineering, was as follows:

The Treatment of Public Water Supplies: NICHOLAS S. HILL, JR.

The Disposal of Sewage by Dilution in New York Harbor Waters: D. D. JACKSON and R. H. BROWN.

Pure Water and the Public Health: GEORGE A. JOHNSON.

Recent Developments in the Design of Garbage Disposal Plants: GUSTAVE R. TUSKA.

The Sterilization of Tannery Wastes: D. D. JACKSON and A. M. BUSWELL.

The Situation regarding the Main Drainage of New York City: KENNETH ALLEN.

The second session was held on the afternoon of Thursday, December 28, in the assembly hall of the Automobile Club of America, under the joint auspices of the Society for the Promotion of Engineering Education, the Automobile Club of America, the National Highways Association, the National Automobile Chamber of Commerce, and Section D, American Association for the Advancement of Science. This session was devoted to highway engineering education. Mr. William O. Wiley, treasurer of the Society for the Promotion of Engineering Education, was in the chair. The attendance was about 85.

The program of the session was as follows:

The Value of a Training in the Humanities for Engineers: NELSON P. LEWIS.

What is Best in Engineering Education: H. H. HIGBIE.

Education in engineering should be primarily a systematic cultivation of the natural abilities of the individual student, and should be concerned only secondarily with acquiring knowledge of facts or of methods of using them. The greatest services which a college may undertake to perform for its students are:

First: To develop traits and habits which produce a creditable and attractive personal address.

Second: To establish a habit of thinking independently, clearly, accurately, usefully and pleasurably.

Third: To ingrain thoroughly some fundamental principles of science to base thoughts upon.

Fourth: To exalt the personal ideals and morals of a student.

Colleges of engineering commonly attempt to impart other things, which the student is not likely to assimilate, namely:

1. Experience and judgment in the applications of scientific principles to practical problems.

2. Special knowledge, expertness or speed in any particular branch of science or art.

3. Equipment of knowledge adequate for any demand without some measure of ingenuity or adaptive ability on the students' part.

Any notable improvements in the functioning of an engineering college will depend upon:

1. Personality, interest, enthusiasm of the teachers and their contact with the students.

2. More general and serious study of educational problems by teachers of engineering.

3. Greater adaptability of the educational system to the individual student.

Criticisms and suggestions are made concerning the teaching of English and foreign languages, specialized or professional courses and mathematics.

Essential Qualifications of Highway Engineers for State, County and Municipal Departments: E. A. STEVENS.

[1] New York, December 28–29, 1916.

The Objects of the Educational Campaign of the National Automobile Chamber of Commerce: Alfred Reeves.

Highway Engineering Electives in the Fourth Year of Civil Engineering Courses: Hector J. Hughes.

The demand for skilled highway engineers raises the question whether the engineering schools are providing the best training possible in this field; if not, should the situation be met by: (1) Specialized post-graduate courses; or (2) by specialized undergraduate courses in highway engineering; or (3) by offering a limited amount of specialized options in the fourth year? Post-graduate work following a good course in fundamentals offers a solution for those few men who can give the additional time and money, but most engineering students can not do so, and this limits the problem chiefly to the four-year courses. In the past, specialized courses have been organized to meet similar needs in other fields; but experience shows that training in the fundamentals is more important than specialized studies. Specialized four-year courses in highway engineering may make the students more successful for a few years after graduation, but the narrowness of such training is likely to limit their usefulness and their opportunities. It appears to be possible to provide in a well rounded four-year program the fundamentals of civil engineering and at the same time to offer small groups of electives in several of the most important special fields of civil engineering.

The Need for Highway Engineering Courses in Civil Engineering Curricula of Western Universities: T. R. Agg.

Limitations of Field and Laboratory Work in Highway Engineering in Civil Engineering Curricula: C. S. Farnham.

Subjects recommended for Inclusion in Civil Engineering Courses to qualify Graduates to enter the Field of Highway Engineering: Arthur H. Blanchard.

The papers and discussions presented at this session will be published in full in the *Bulletin* of the Society for the Promotion of Engineering Education.

The third session was held on the evening of Thursday, December 28, in the assembly hall of the Automobile Club of America under the joint auspices of the Automobile Club of America, the National Highways Association, the Motor Truck Club of America, the National Automobile Chamber of Commerce, the Citizens' Street Traffic Committee of Greater New York, and Section D, American Association for the Advancement of Science, Vice-president Dr. Henry M. Howe was in the chair. This session was devoted to highway engineering, and the attendance was about 130.

The program of the session was as follows:

The Interrelations of Seaport, Railroad and Highway Terminals: Calvin Tomkins.

Highways formerly were and railroads now are the principal land factors in transportation.

Definition of port terminal service.

Growing importance of motor trucks and highways as feeders to railroads and waterways—and for short hauls.

Breakdown of transportation at city terminals a consequence of difficulty in adapting and expanding these terminals to changing conditions.

Necessity for segregating terminal charges from transportation charges in order to obtain revenue to finance modern terminals.

Large proportion of railroad capital unprofitably invested in terminal properties which should be made public and integrated as administrative units.

Terminal reorganization involving parity of opportunity for all carriers and shippers and real-estate owners, interferes with vested interests based on bad terminal practises. Improvements are consequently delayed.

Rotary Traffic, Accomplishments and Possibilities: William P. Eno.

In 1903 the "rotary system" was suggested for Columbus Circle and put in use in 1905. In 1907 it was adopted at the Arc de Triomphe in Paris. Now it is in effect at all circles in all cities where there is any intelligent attempt to regulate traffic.

The "rotary system" could be made to replace the "block system" at simple intersections in all cases where there is sufficient turning space. It has been adopted in other cities but New York has so far failed to profit by it. Its installation on Fifth Avenue would largely eliminate blockades and would add at least 25 per cent. and possibly as much as 50 per cent. to the traffic capacity of the street. A fair trial could be made at such slight cost that the saving in one day by its operation would pay for the trial. It should therefore be put into effect without unnecessary delay and the "Go Go" semaphores should be discontinued as they are worse than nothing.

Recent Investigations of Tractive Resistance to Motor Trucks: A. E. Kennelly and O. R. Schurig.

Printed in Science, April 6, p. 341.

Speed Governors for Motor Trucks: THEODORE DOUGLAS.

There are various types of governors available of which about 95 per cent. are of the centrifugal variety. The constant-engine-speed governor ties up from 20 per cent. to 50 per cent. of the power capacity of the engine and sacrifices both gasoline and engine efficiency. The constant-vehicle-speed governor regulates only the vehicle speed and sacrifices the engine through allowing a prohibitive speed on low gears, and no control at all in idling. It is shown that the *ideal governor* would be a combination of the constant-engine-speed and the constant-vehicle-speed governors. A governor of this combination type is now available in the industry.

This governor may be broadly described as a combination of two-speed controls operating a single centrifugal unit and actuating a single valve. This is accomplished through the employment of two springless pawl clutches so designed that each may overrun the other. Whether the speed from the engine or from the vehicle is the higher speed, that speed will engage the centrifugal unit and close the valve.

By the use of the combination type governor, truck efficiencies have been largely increased, and a perfect automatic control has been supplied.

Factors controlling Maximum Overall Dimensions of Motor Trucks: ALFRED F. MASURY.

Traffic Census Analysis: WILLIAM H. CONNELL.

In order to work out a suitable highway design, it is necessary to make a study of the traffic conditions, and upon the collection of adequate data and its careful analysis may be based: (*a*) the plan of a highway with respect to its lines, grades, widths and location of roadways, footways and lawn areas; (*b*) the design of a pavement surface and base best suited to the traffic requirements; (*c*) an estimate of the probable relation between traffic service and maintenance costs; (*d*) the character and time of cleaning best suited to the prevailing types of traffic; and (*e*) the physical regulation of traffic with respect to the direction of flow, crossings, parking areas, safety islands and zones, and safety and regulating signals.

The several lines of investigation which are necessary to a comprehensive traffic study may be indicated as follows: (*a*) the survey, which determines the nature of the existing physical and other conditions influencing or relating to the traffic; (*b*) the census, which records the quantity, character and weight of traffic; and (*c*) the planning, through which it is sought to develop a more consistent relation between traffic requirements and traffic provision.

In most traffic census, it has been the general practise to consider "ton of traffic per foot width of pavement" as a proper unit. It would seem that the most logical and satisfactory unit of traffic measurement would be the "ton-mile" or its multiples per foot of maximum travelled width of pavement.

The Most Satisfactory and Economical Pavement for Parkway Drives: SAMUEL WHINERY.

Present Status of Preliminary Location and Mapping of National Highways proposed by the National Highways Association: CHARLES HENRY DAVIS.

Possible Variations of Physical Properties of Rock from One Quarry: CHARLES P. BERKEY.

Stone and Concrete Foundations from the Standpoint of Efficiency and Economy: GEORGE C. WARREN.

The words "Efficiency and Economy" each in their broadest sense mean practically the same thing and the same as the word "best," when considered in its broadest sense of "all things considered."

There is no one "best" for all conditions and an engineer who would recommend any one type of pavement surface or foundation as universally best, would be like an architect who specified one class of building material as best for all buildings, *i. e.*, a "man of one idea."

In determining the character of foundation best suited for any particular case, the engineer or road-builder should give most careful consideration to the character of subsoil, traffic, wearing surface to be laid on the foundation, and climatic conditions.

Block pavements of all kinds should be almost universally laid on concrete foundations. Monolithic bituminous pavement surfaces depending on stability of the surface and local conditions outlined above, may be laid on either rolled broken stone or concrete foundations.

Concrete includes any dense combination of mineral aggregates in which the coarser sizes predominate artificially bound together with either Portland, bituminous, or any other type of cement.

Generally speaking, broken-stone foundation is adapted for cases where the rolled subgrade is of a character of material which can be solidly compressed. It has been found that sand provides a good sub-base provided the sand is sprinkled during the rolling of the broken stone, thus providing a sub-base condition like damp sand on the beach.

Concrete foundations should be used on weak subsoil of clay, etc. Portland cement concrete roads and foundations crack, causing corresponding cracks in the pavement surface, which is retarded by the use of either broken stone or bituminous concrete foundation. Bituminous pavement surfaces are more liable to creep on Portland cement concrete than on broken stone or bituminous concrete foundations, as in the latter cases the surface and foundation are firmly united to each other. Portland cement concrete foundations should be used where a maximum rigidity is essential.

Present Status of Bituminous Surfaces on Gravel Roads: John R. Rablin.

Value of Physical Tests on Bituminous Aggregates: Prevost Hubbard.

Proportions of Ingredients of Bituminous Mortars Used for Fillers: Phillip P. Sharples.

Bituminous mortars used for fillers in block pavements have been used in the United States of America since 1913. These fillers consist of mixtures of coal tar pitch and sand, or asphalt and sand. Specifications for both kinds were adopted at the 1916 meeting of the American Society of Municipal Improvements.

These bituminous mortars are particularly well adapted for use in filling the joints of stone block, brick, lug wood block and Durax pavements. Observation shows that the asphalt-sand mastic does not fill the joints as well as the pitch-sand mortar, owing to the higher melting point of the former and its lower adhesive value.

Summary.—Those bituminous mortar fillers that have given trouble to date have done so because not sufficient sand was originally mixed with the bitumen. A fine sand gives much better results than a coarse sand, and more of it can be introduced in the mastic. By properly heating and applying, a mastic with equal parts, by volume, of sand and bitumen can be forced into the joints of block pavements. For special conditions, special grades of bitumens must be used. Hand mixing is cheaper than machine mixing, and as good. The pouring method should be entirely dispensed with and the flushing and squeegeeing method substituted.

Present Status of Physical Tests for Granite Blocks: C. D. Pollock.

This paper gives the progress made in tests of granite for paving blocks and reviews the changes made in such tests in standard specifications which have been in very general use.

Even the latest tests are far from ideal, as the conditions which prevail in the tests do not approximate those which exist in actual traffic on the pavements.

Engineers are now studying this question and undoubtedly will work out some tests which will more nearly conform to the wear and tear of the traffic on the granite block pavements in the street.

The service test at the present time is the only sure and reliable test.

Joint Fillers for Granite Block Pavements: Herman H. Schmidt.

In this paper the development of the granite block pavement is traced from the first granite pavement laid which resembles our modern granite pavement, up to the present highly improved granite pavement, as laid in our large cities.

A detailed statement of the requirements of ideal joint fillers is given, followed by a discussion of the various joint fillers used and available. In this discussion the defects in each are pointed out, and the writer suggests what in his estimation would be an ideal joint filler.

There is also a brief discussion of methods for applying joint filler, and mention is made of the character of the cushion course which will give best results.

The writer's conclusion is that with slight changes in the methods of work and improvement in the character of joint filler, granite pavement will have reached the highest state of development of which it is capable.

The Real Sources of Trouble in Brick Pavements: Maurice B. Greenough.

The most common imperfections in brick pavements are caused by non-enforcement of adequate specifications reflecting the best procedure of modern methods. One hundred per cent. construction is not possible of attainment under some specifications in force which are indefinitely worded and incomplete. Few imperfections are caused by brick of poor quality. The American Society for Testing Materials has adopted procedures which, if followed, insure securing the required degree of quality in the brick. Monolithic construction, while not a panacea for all brick pavement troubles, eliminates the hazards of a faultily prepared sand cushion and affords a large measure of protection against most brick pavement imperfections.

A. H. Blanchard,
Secretary

(To be concluded)